SCAQMD Remote Sensing HEROS Program

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South Coast AQMD

High Emitter Repair or Scrap Program (HEROS)

- Assembly Bill 923
- High Emitter Identification Via Remote Sensing
- Vehicle Repair Assistance - $500 Per Vehicle
- Vehicle Retirement - $1,000 Per Vehicle
- Low Income Eligible Consumers
  - Documentation of low emission vehicle or cleaner replacement vehicle
  - Additional $1,000 incentive

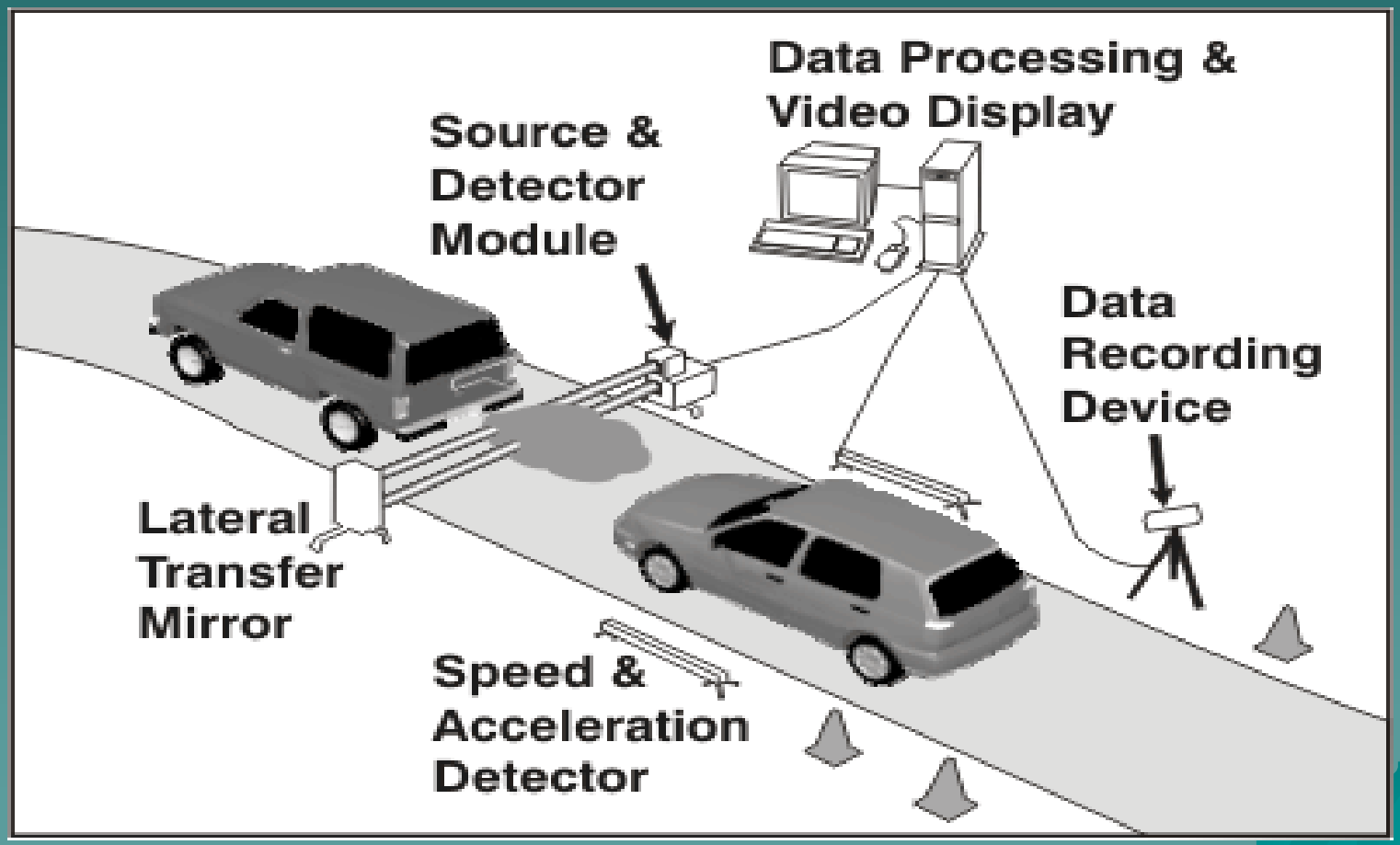
AQMD Remote Sensing Program

- Moyer Funded
  - Subject to cost effectiveness threshold of $14,300/ton of pollutants reduced
- Program Components
  - Remote sensing
  - Database development
  - Outreach to and solicitation of vehicle owners
  - Repair or scrapping of high emitting vehicles

HEROS Background

- Repair or Scrap High Emitting Vehicles Identified by Remote Sensing
- Goals
  - 1 million unique vehicle RSD readings
  - 3,000 to 5,000 vehicles voluntary participation
- $4 Million Budget
- Contractors: ESP, FCCC, and Pick-Your-Part

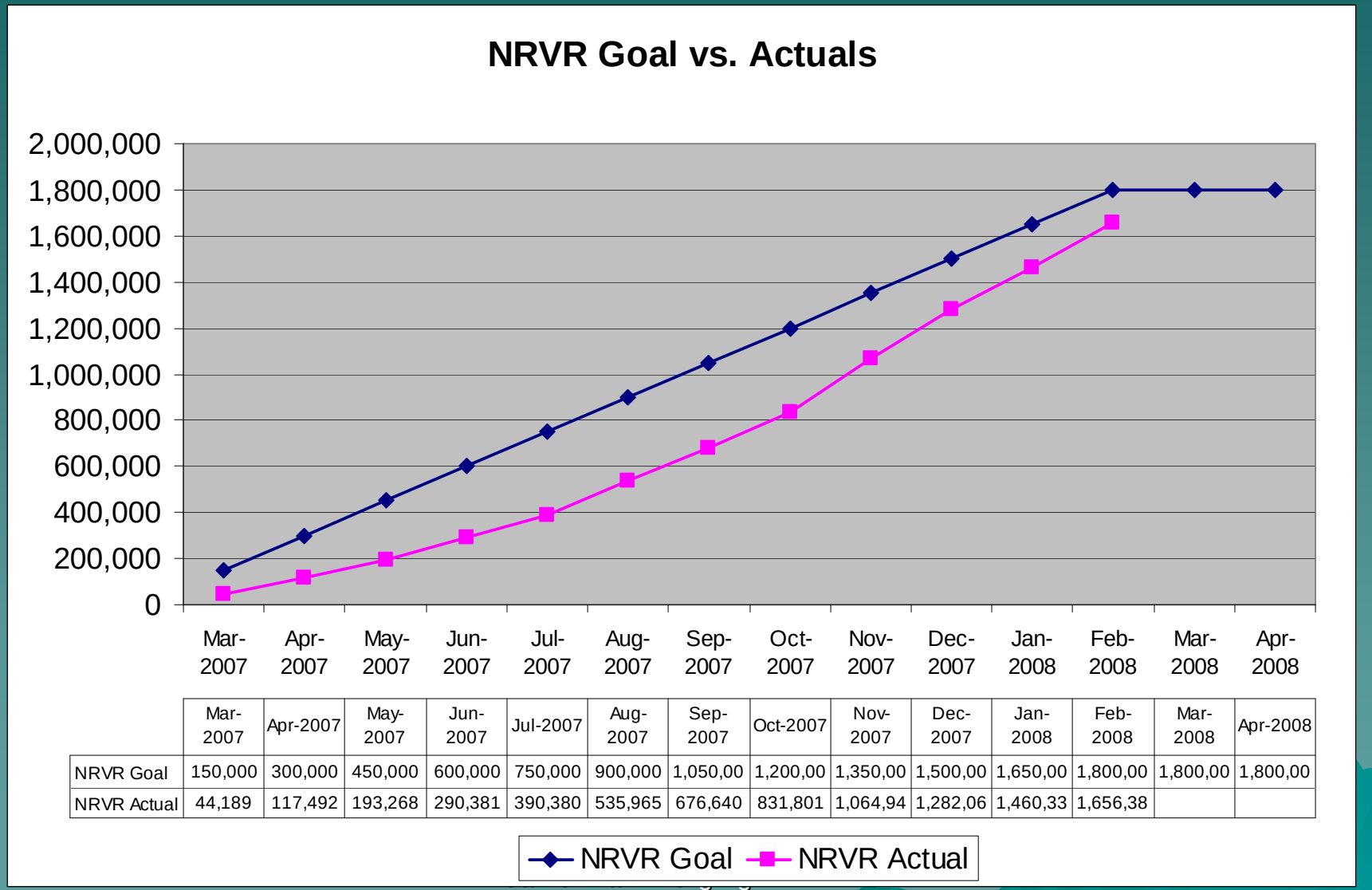
Remote Sensing – Mobile Source



* Limited Exceptions Allowed Under Carl Moyer Guidelines

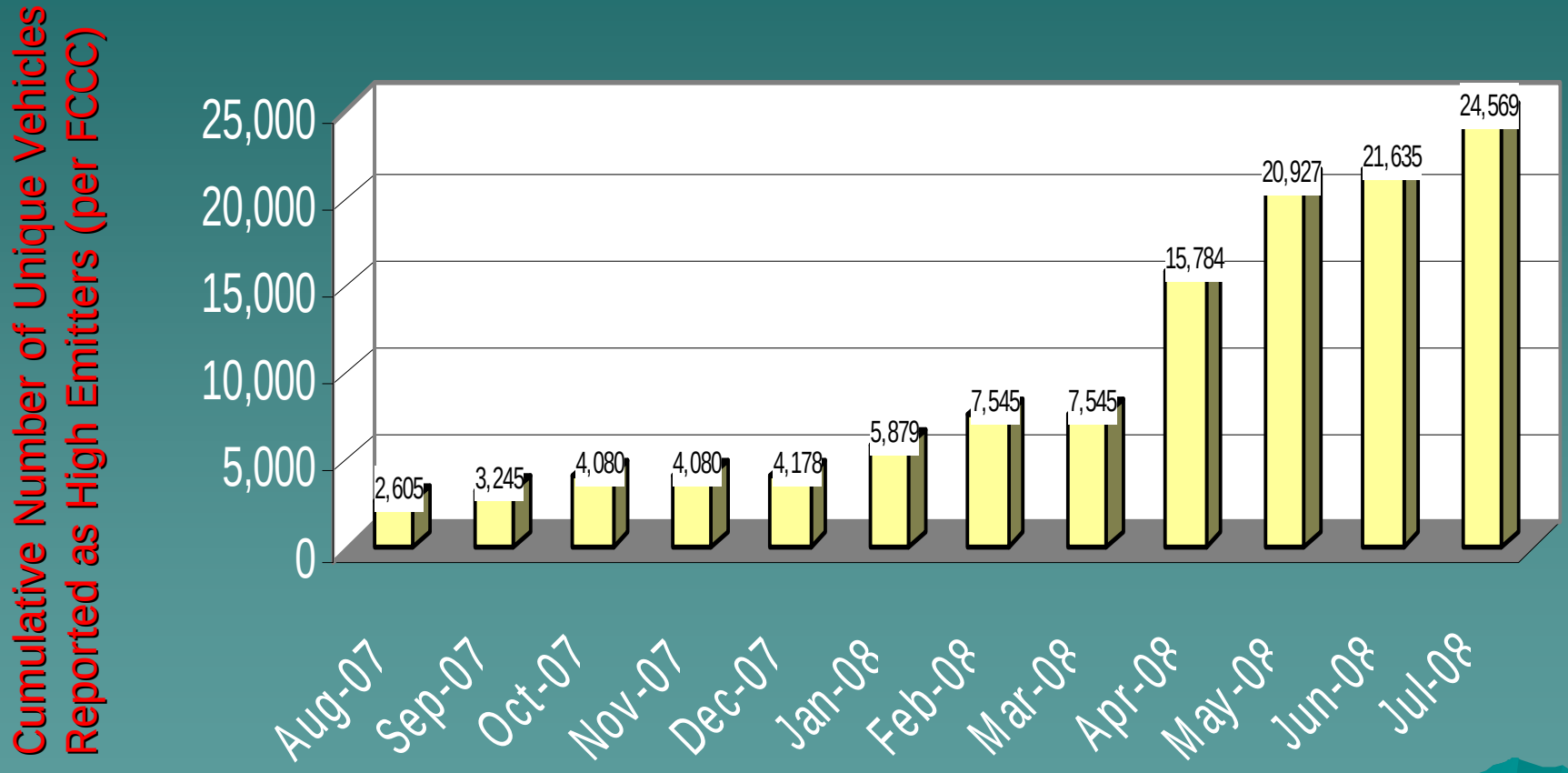
Remote Sensing

Non-Repeated Valid Readings (NRVR)



	Mar-2007	Apr-2007	May-2007	Jun-2007	Jul-2007	Aug-2007	Sep-2007	Oct-2007	Nov-2007	Dec-2007	Jan-2008	Feb-2008	Mar-2008	Apr-2008
NRVR Goal	150,000	300,000	450,000	600,000	750,000	900,000	1,050,00	1,200,00	1,350,00	1,500,00	1,650,00	1,800,00	1,800,00	1,800,00
NRVR Actual	44,189	117,492	193,268	290,381	390,380	535,965	676,640	831,801	1,064,94	1,282,06	1,460,33	1,656,38		

Remote Sensing Data



2007 High Emitter Rates

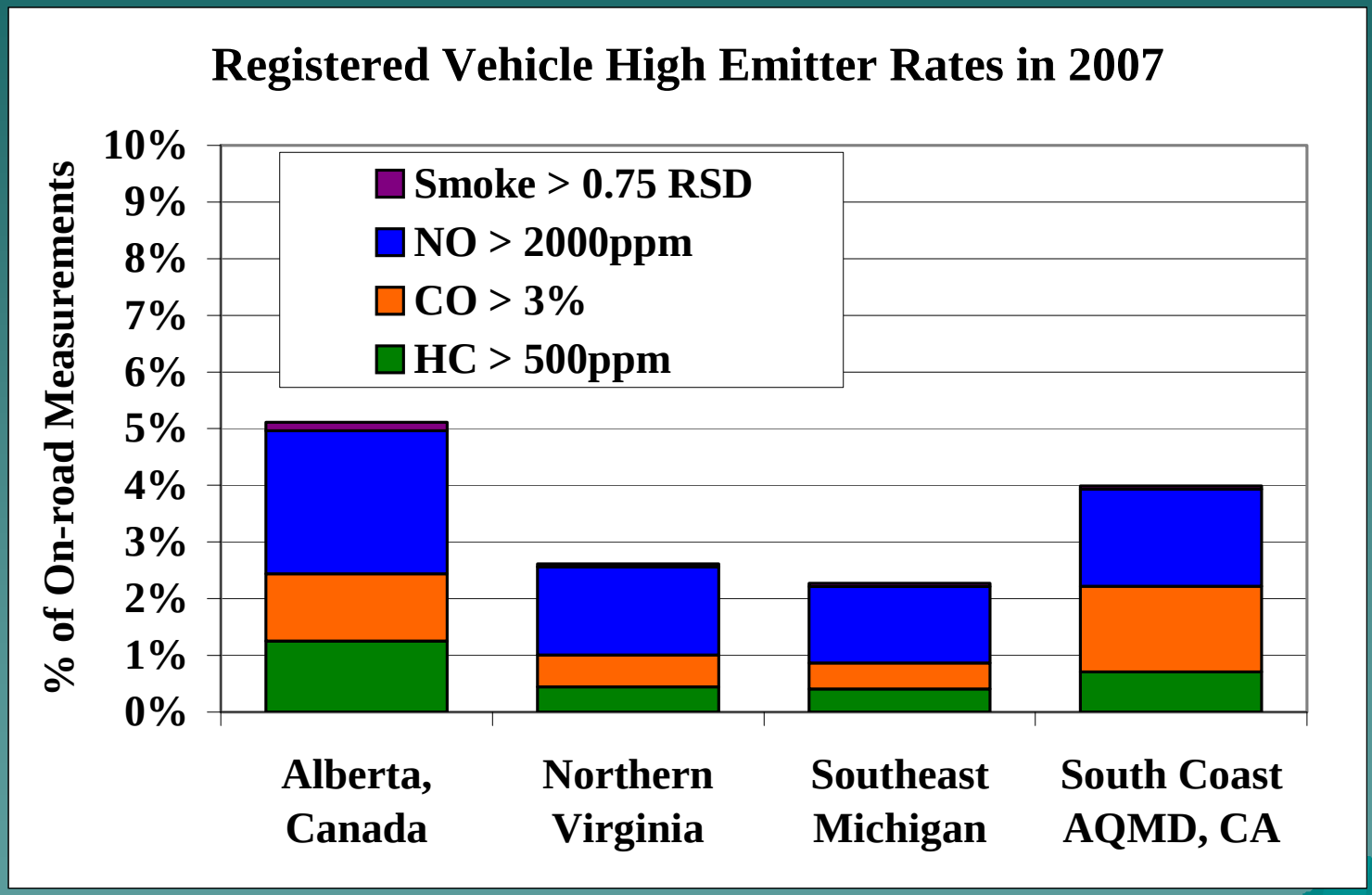
Percent of Measurements

	(No I/M) Alberta	Virginia Non-I/M	Virginia I/M	(No I/M) Michigan	SC AQMD
HC > 500ppm	1.3%	0.7%	0.4%	0.4%	0.7%
CO > 3%	1.2%	0.9%	0.6%	0.5%	1.5%
NO > 2000ppm	2.5%	2.6%	1.6%	1.4%	1.7%
Smoke > 0.75 RSD	0.1%	0.1%	0.1%	0.1%	0.1%
Combined	4.6%	3.9%	2.5%	2.0%	3.6%

Average On-Road Emissions

	Alberta VSP 5-20	Virginia Non-I/M	Virginia I/M	(No I/M) Michigan	SC AQMD
Average HC ppm	48	27	20	16	34
Average CO %	0.18	0.15	0.12	0.11	0.19
Average NO ppm	250	262	208	158	229
UV Smoke RSD	0.027	0.015	0.010	0.015	0.016

2007 High Emitter Rates



Alberta, Canada & Michigan – No I/M Northern Virginia has I/M Similar to California's

AB 1222, Jones (2005) Remote Sensing Pilot Program for Railroad Locomotives

AB 1222 - Requirements

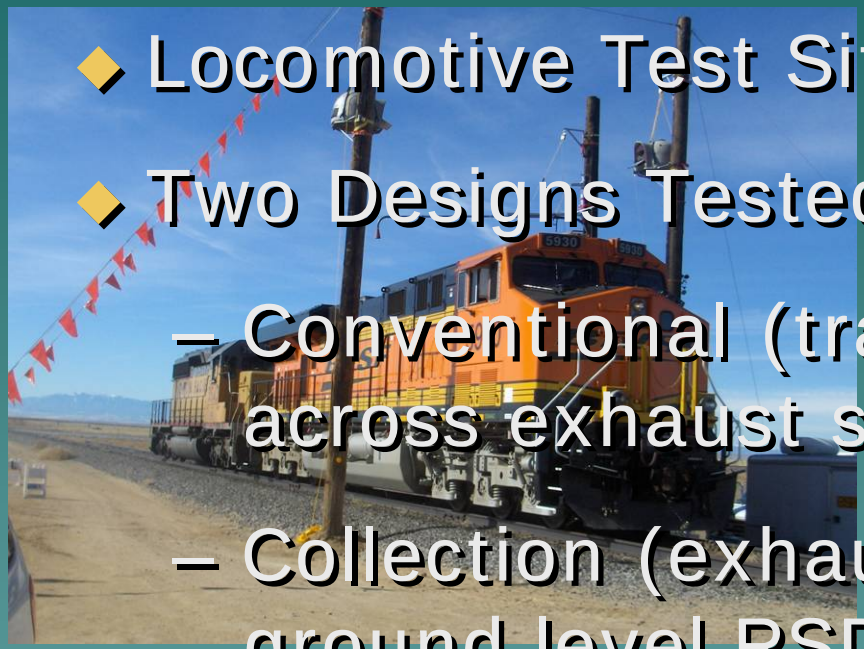
- In 2005 SCAQMD sponsored legislation (AB 1222) to evaluate feasibility of RSD technology in measuring and identifying higher emitting locomotives.
- CARB to implement pilot program to determine the accuracy and reliability of remote sensing device technology to measure emissions from in-use locomotives.
- CARB to work with Advisory Group:
  - experts in remote sensing, locomotive engine technology, representatives of citizen community groups, SCAQMD, Sacramento Metropolitan AQMD, UPRR and BNSF Railway.

AB 1222 – Pilot Program Design

Three Phase Program

- Phase 1- Proof of Concept: adapt RSD to locomotive exhaust characteristics and operations, e.g. Line Haul and Yard operations.
- Phase 2 - Field Measurements: In-Use Line-haul and Yard locomotive monitoring.
- Phase 3 - Correlation Testing: Simultaneous emissions measuring using RSD and EPA Federal Test Procedure (FTP).

Phase One – RSD Adaptation



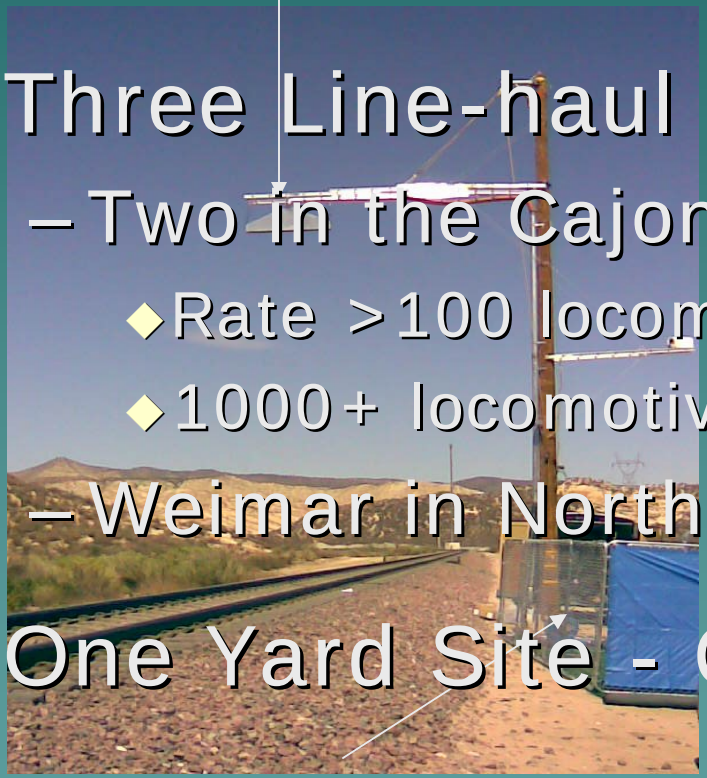
- Locomotive Test Site - Pueblo, CO
- Two Designs Tested
  - Conventional (transmitter and reflector across exhaust stream)
  - Collection (exhaust cooled and brought to ground level RSD system)
- Collection design selected

Exhaust Collection Design with Ground Based RSD

Conventional RSD Design with Locomotive RSD Transmitter and Reflector

Phase Two – Measuring Emissions from In-Use Locomotives

Exhaust Collection System

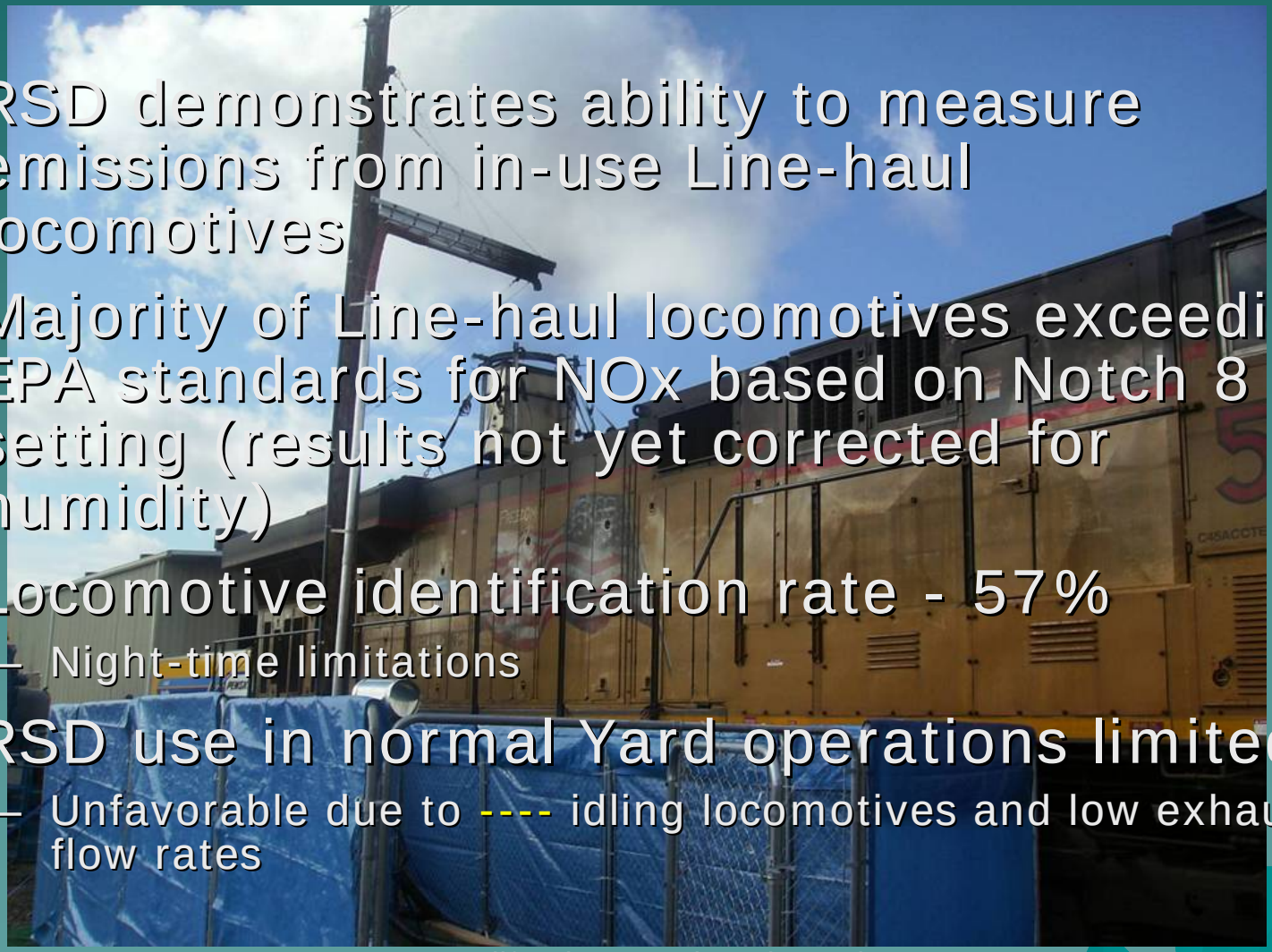


RSD Equipment on Ground

Line-haul Locomotive / Train Passing under Exhaust Collector

- Three Line-haul Sites
  - Two in the Cajon Pass Southern CA
    - Rate >100 locomotives/day
    - 1000+ locomotives monitored over 17 days
  - Weimar in Northern CA
- One Yard Site - Colton

Phase Two Preliminary Results



- RSD demonstrates ability to measure emissions from in-use Line-haul locomotives
- Majority of Line-haul locomotives exceeding EPA standards for NOx based on Notch 8 setting (results not yet corrected for humidity)
- Locomotive identification rate - 57%
  - Night-time limitations
- RSD use in normal Yard operations limited
  - Unfavorable due to ---- idling locomotives and low exhaust flow rates

Phase 2 – RSD Measurements (Cajon Pass)

Draft

			Union Pacific			Burlington Northern Santa Fe		
Tier	EPA NOx Std.	In-Use* Test Data ('05-'06)	Loco-motives Measured	Above EPA NOx Std.	Above In-Use	Loco-motives Measured	Above EPA NOx Std.	Above In-Use
	g/bhp-hr	g/bhp-hr		%	%		%	%
Pre-0	-----	13.5	15	-----	27%	48	-----	33%
0	9.5	7.8	22	41%	86%	579	40%	90%
1	7.4	6.8	14	93%	93%	230	75%	91%
2	5.5	4.7	39	79%	100%	196	85%	99%
			90			1053		

* In-Use Test Data (except for pre Tier0) are from average 2005 and 2006 data from AAR (Association of American Railroads).

Phase 3 – RSD/FTP Correlation

- Simultaneous measurement of locomotive emissions:
  - Line haul duty cycle compared with RSD
  - U.S. EPA Federal Test Procedure (FTP) certification testing (40 CFR Part 92)
  - Blind testing (no sharing of results during tests).
- Two locomotives tested Jan./Feb. 2008 by ESP and SwRI:
  - UP9611 (Tier 0) (2 tests compared)
  - UP5436 (Tier 2) (3 tests compared)

Phase Three – Preliminary Results

- RSD NO_X and PM measurements within each notch setting show little variability, especially within higher notch settings.
- Average RSD NO_X measurements over the duty cycle are close to the FTP NO_X measurements.
  - Notch setting known.
  - Controlled conditions.
- Average RSD PM measurements over the duty cycle are very close to the FTP PM measurements for the Tier 0 locomotive
- Average RSD PM measurements over the duty cycle are very close to the FTP PM measurements for 2 of the 3 Tier 2 locomotive.
  - On 2nd test RSD was 2.5 times the FTP value because of high PM readings at lower notches.

Summary of AB1222

- CARB preparing final report with input from Advisory Group
- Preliminary findings indicate RSD accurately measuring in-use locomotive emissions (Phase 2)
  - Majority of in-use locomotives appear higher than the certification standard
  - May provide means of identifying high emitters
- May provide satisfactory means of evaluating EPA's locomotive emission standards on-site (Phase 3).
- RSD deployment in the field may be feasible to monitor in-use emissions from locomotives